

LOCK-RIGHT™ Performance Locker Installation Manual

Two- or four-pinion differential; two-piece capped case

Typical of Ford® 9-inch 28-, 31-tooth, VW® 002,091, etc.

Introduction.....	2
Background Information.....	3
Installations Covered.....	5
Preliminary Steps.....	5
Differential Case Removal.....	5
Disassembly of Differential Case.....	7
Inspection of the Parts.....	7
Preparing Parts for Assembly.....	10
Assembly of the Parts.....	10
Differential Final Assembly.....	13
Differential Assembly Inspection.....	17
Third Member Installation.....	17
Vehicle Final Assembly.....	18

Tire Diameters.....	18
Testing Your Installation.....	19
Driving Your Vehicle.....	19
Warranty Information.....	20



Introduction

Welcome to the growing family of **LOCK-RIGHT** owners! This manual will help you install your new **LOCK-RIGHT** automatic 100% full-locking differential. When the installation is complete, your vehicle will have *extreme* traction! We trust that you will be pleased with its performance and thank you for your confidence in our products.

LOCK-RIGHT installation simply involves disassembling and re-assembling the differential case, replacing a few parts in the process. These instructions are detailed to the point that a person who is reasonably familiar with automotive work can install a **LOCK-RIGHT** into a third member in about three to four hours; please read them carefully before you start to be sure that you thoroughly understand them. Do not attempt shortcuts unless you know exactly what you are doing. These instructions also assume that you have the proper shop

manual for reference to instructions about axle removal, torque values, settings, clearances, etc. Our manual is a general guide to operations but does not repeat all the shop manual details.

This manual primarily describes the assembly of the two- or four-pinion two-piece differential case that has a cap held on by the ring gear bolts. Some references may be made to the front axle or to 4x4 operation; if your vehicle is a 4x2, ignore them. Note that most of the photos are of a Ford® 9-inch assembly; however, the installation of the **LOCK-RIGHT** itself into the differential case is the same for VW® differentials and for others as well.

We suggest that your first installation be done in the rear axle. This is because the initial weight of the engine over the front axle is reduced by weight transfer to the rear as your vehicle climbs a hill, meaning that more and more weight is being applied to the axle with the locker in it as more traction is needed. If the locker is in the front, tractive weight becomes less as the hill becomes steeper.

Remember: This instruction manual is provided for your convenience to assist you or your mechanic with the installation of your new **LOCK-RIGHT**. However, the ultimate responsibility for the success of your installation and the subsequent proper operation of your vehicle rest with you, the vehicle owner.

When your installation is complete, you will have a vehicle with significantly increased capabilities. For continued “fun in the sun,” operate it in a safe and responsible manner. *Be sure to read and understand the driving information* in the **LOCK-RIGHT** Vehicle Owner’s Manual!

Background Information

The differential **case** is the round housing inside the rear axle assembly to which the ring gear is bolted and which contains the differential spider and side gear assembly. It is installed in the differential carrier, which is the housing that holds the case, drive pinion gear, bearings, etc. The carrier may be removable (as part of a “drop-out” unit, or third member), or it may be integral (as a permanent part of the axle assembly, mounted in the

vehicle). This manual covers both types of Differential and Carrier Assembly, but note that the pictures are of a removable third member.

The **LOCK-RIGHT** is designed to fit into **standard open differential cases only**, not into limited-slip cases. If your vehicle contains a limited-slip unit you will need to purchase a standard open differential case, side gears, thrust washers and long pinion shaft (and also the two short shafts if it is a four-pinion unit) before proceeding.

A word about side gear thrust washers: All differentials originally had a thrust washer under each side gear. Thrust washers are large in diameter and between about 1/32-inch (.031, or 0,76-mm) and 1/16-inch (.062, or 1,52-mm) thick. If either one or both are missing from the original differential, **obtain new one(s) before proceeding!**

The **LOCK-RIGHT** is designed to be used with a correct thrust washer under **each** side gear, and failure to use this washer is easy to observe during inspection and will void the warranty.

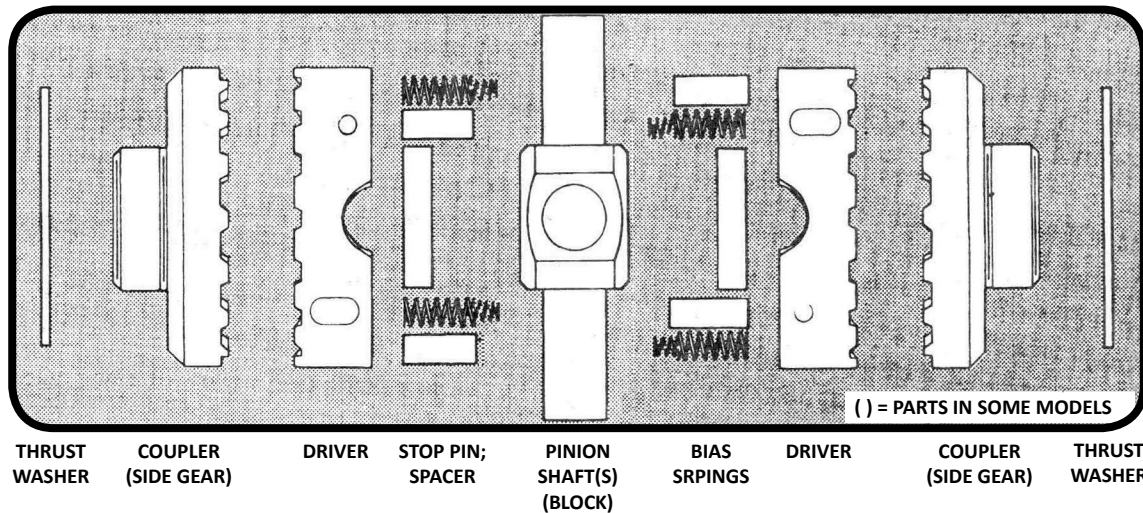


Figure 1
LOCK-RIGHT Exploded View

NOTE: The parts shown in the various figures are typical and may not exactly depict your particular model.

LOCK-RIGHT Installations Covered in This Manual

Capped case differentials, both removable third member axles and integral carrier axles. Typical of these are those in **Ford® 9-inch** rear axle-equipped vehicles; similar other applications, such as **VW® 091, 002**, etc.

Preliminary Steps

The following steps are only a general guide to preliminary operations used for preparing your vehicle for **LOCK-RIGHT** installation. For detailed information, refer to your shop manual. In general, the preliminary steps include:

- a) Blocking the vehicle**, putting transmission in neutral;
- b) Loosening the wheel lug nuts** (tire removal may be optional; see shop manual);
- c) Jacking up the axle**; securely resting it on jack stands;
- d) Removing the tires** (some axles);

- e) Disconnecting the brake lines** and emergency brake cables (some axles);
- f) Pulling out both axles** a few inches.

Differential Case Removal

1. Remove the third member or differential case from the vehicle as outlined above and described in the shop manual. **Follow all safety precautions.**

2. Check to be sure that the gears are in good condition and that nothing is loose, worn or scored. Rock the ring gear back and forth to get a “feel” for the backlash and check to see that it appears to be set up properly. If any out-of-spec conditions exist, be sure to correct them before subsequent re-assembly.

3. The differential can be removed and re-assembled without changing the ring and pinion settings if you are careful. **Mark everything** with a center punch! Don’t touch a bolt until you have done so. we suggest placing the whole assembly upright (the same position as show in the vehicle), looking at the

ring gear end. Mark the carrier and bearing cap **on the ring gear side with one punch mark** and on the **other side with two marks (Figure 2)**. The caps are not interchangeable! Also mark each bearing adjuster directly under the lock hole with this same mark to note its side and rotational position. *This mark is very important to correct re-assembly!*

4. Remove the adjuster locks. Be sure that each adjuster is marked at the lock hole with the correct number of punch marks for each side. The adjusters are not interchangeable after they are marked for position! (In general, the adjuster locks themselves are interchangeable.)

5. Remove the bearing caps.

6. Slide (tap) the adjuster up and out and remove the bearing race on the ring gear side first and put a very small grind mark on the outside of the race to mark it. Scraping it on a cement floor also works, or you can use a tag. Be sure that you can identify it for proper re-assembly on the correct side!



Figure 2
Mark carrier, caps, adjusters at lock hole

7. Remove the differential case and ring gear assembly from the carrier along with the other adjuster and bearing race.

Disassembly of the Differential Case

1. Remove the ring gear bolts and then the ring gear. It may need to be tapped off with a brass mallet. Mark it so that it can be re-installed in the same rotational position as when removed. Also mark the cap and case so that they can be re-assembled together in the same position.

2. Remove the case cap. It may be pressed into position; carefully pry it up if necessary.

3. Remove the pinion shaft(s), spider gears, side gears, all washers, and the pinion shaft block.

4. Mark the side gear in the top of the case with a tag or put it in a separate location so that it can be identified later. It will be placed in the **bottom** of the case during assembly.

Inspection of the Parts

NOTE: These steps are important. The **LOCK-RIGHT** differential assembly utilizes your case, side gears, all washers, pinion shaft(s), and they must be in excellent condition. The spider gears and washers are not used. If following inspection shows that anything is bad, buy new parts from your dealer!

1. Thoroughly wash the differential case and remaining parts with solvent, then dry them. Be sure to keep the side gears separate.

2. Inspect the side gears. They are very important to the proper operation of your new **LOCK-RIGHT**. The following three figures show various levels of wear on the teeth.

a) New side gear (Figure 3). Note that the surface is rough and that machining marks are present on the side of the tooth. Will function properly.

b) Moderately used side gear (Figure 4). Note that polishing is evident but that some



Figure 3
New side gear. Note rough surface and marks



Figure 4
Moderately used side gear. Note polish, marks



Figure 5
Heavily used side gear. Note high polish, shape

machining marks are still present. Should function properly.

c) Heavily used side gear (Figure 5). Note that the tooth surface is highly polished and that the side of the tooth near the top is rolled somewhat flatter. Will not function—should be replaced.

3. Inspect the pinion shaft(s) for any galled areas or grooves. If they are not in excellent condition, obtain new ones.

4. Inspect the side gear thrust washers. They are important to the correct positioning of the **LOCK-RIGHT** parts. If they are excessively worn or are cracked, obtain new ones.

5. Inspect the case for any chips, cracks or similar damage. Also inspect the bearings. If the case or bearings look bad, replace them. However, if you do, remember that the marked bearing adjuster positions no longer will be correct; the ring and pinion backlash and bearings pre-load will to be reset with a dial indicator as described in the shop manual.

Preparing the Parts for Assembly

Coat the teeth of the side gears and both sides of the thrust washers with medium grease. Also place a little **grease in each of the four holes** in each driver. The grease will help hold the parts in place later and assist with functioning until the gear oil circulates.

Assembly of the LOCK-RIGHT Parts into the Differential Case

1. Place a thrust washer into the bottom of the case, smoothest side up, and place the gear that formerly was in the top of the case into the bottom (**Figure 6**).

2. Place a driver onto the side gear in the case with the teeth meshed (see **Figure 7**).

3. Install the pinion shaft block and the pinion shafts (see sections a and b below). Be very careful to not let the shafts become caught on the driver or the block or on each other as they come through! Keep the retaining pin holes in the shaft(s) lined up with thoes in the case and finish driving them in. If they

are hard to insert, use a brass or plastic mallet to drive them to avoid damaging the ends. If the shafts will not insert all the way because the block appears to be too thick, thinner thrust washers will be needed. Either purchase them from your dealer or reduce them in thickness with a surface grinder. Only a few thousandths of an inch may need to be removed.

a) Four-pinion case: Place the pinion shaft block into the center of the driver. (The two stub shafts in your kit will not be used.) Drive the two short shafts part way into the block first to help hold it and then drive in the long shaft (**Figure 7**).

b) Two-pinion cases: Place the two stub shafts in your kit into the pinion shaft block, and place the assembly into the center of the driver. Spread the shafts apart with a screwdriver (**Figure 8**). Drive in the long shaft past the two stub shafts (**Figure 9**). The case will hold the shafts in place.

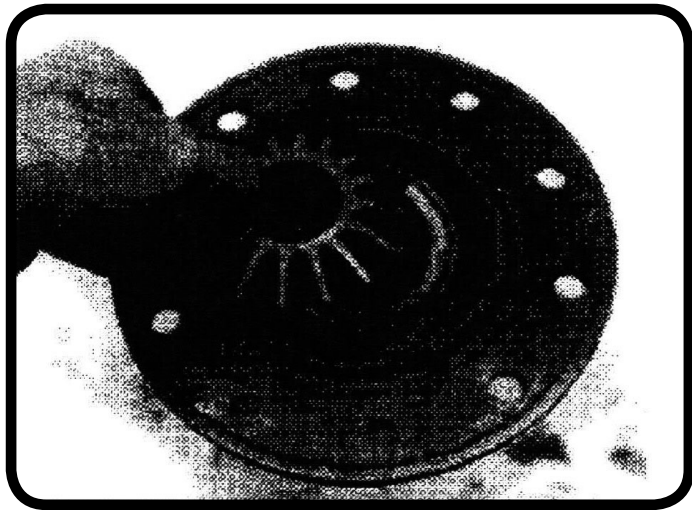


Figure 6
Place thrust washer, former top side gear in case

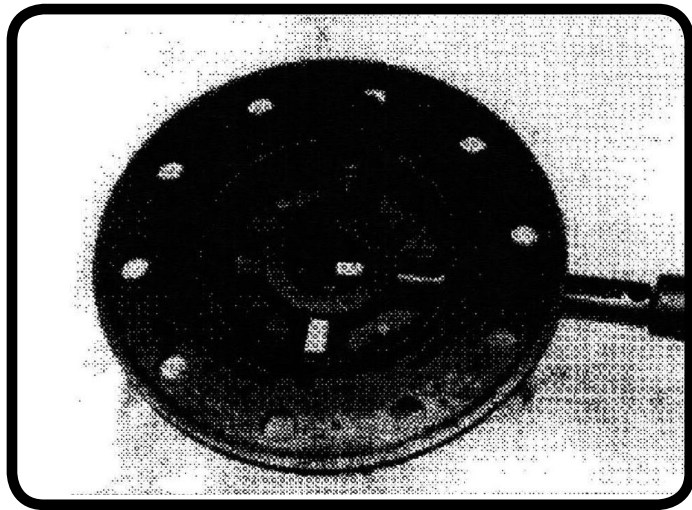


Figure 7
Install parts; drive in short shafts and long shafts

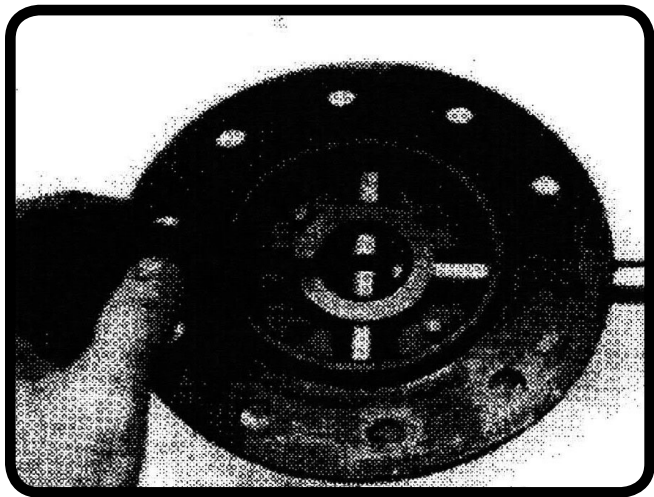


Figure 8
Install driver, shafts/block; spread shafts apart

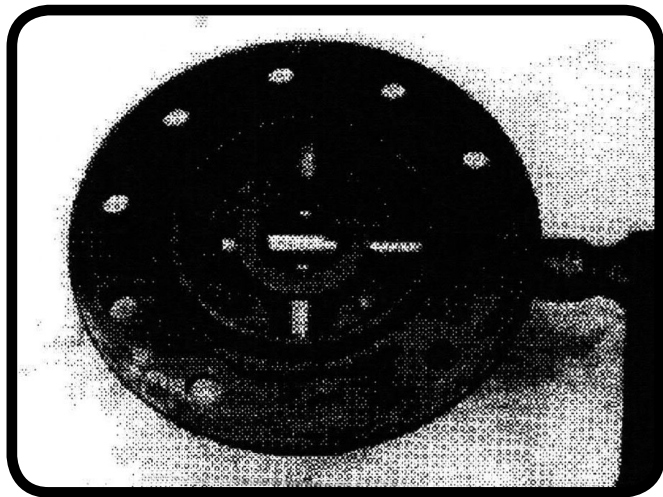


Figure 9
Drive in long shaft past stub shafts

4. Place a bias spring assembly into each deep hole in the bottom driver and place a pin into each of the two other holes. The grease placed in the holes earlier will help hold things in place.

5. Place a bias spring assembly into each deep hole in the other driver and place a pin into each of the other holes. Use grease to help hold them in place (**Figure 11**).

6. Turn the top driver over and hold it so that the stop pins line up with the springs in the lower driver. Carefully lower it until the pins rest on the discs (**Figure 12**). Push it up and down to be absolutely sure that all springs and pins are in place and are functioning properly. Proper operation of the parts at this point is **very** important!

7. Place the other side gear (the one that formerly was in the bottom of the case) onto the top driver with the teeth meshed and then place the thrust washer on it (**Figure 13**). The smoothest side of the washer is placed next to the gear.

8. Place the case cap onto the case in its marked rotational position. Line up the ring gear holes and tap it to seat it.

9. Install the ring gear in its proper marked rotational position and then torque the bolts to their proper values.

10. Inspect your work. Look for anything that is not correct. Reach in through each end with two fingers into the splines and be sure that the drivers rotate back and forth smoothly, stopping at the pinion shafts, and are not binding.

Differential Final Assembly

NOTE: Integral carrier differentials use steps similar to those for third member differentials when installing the bearing caps and adjusters. Install the case as described below except for the positioning of the carrier vertically.

1. Position the carrier vertically, with the drive shaft flange pointing down. It can be held in a vise or even stood on its nose in a coffee can if a vise is not available.

2. Place the bearing races on the differential bearings. Be sure to place the marked one on the proper end.

3. Set the differential case (and bearings) into the carrier.

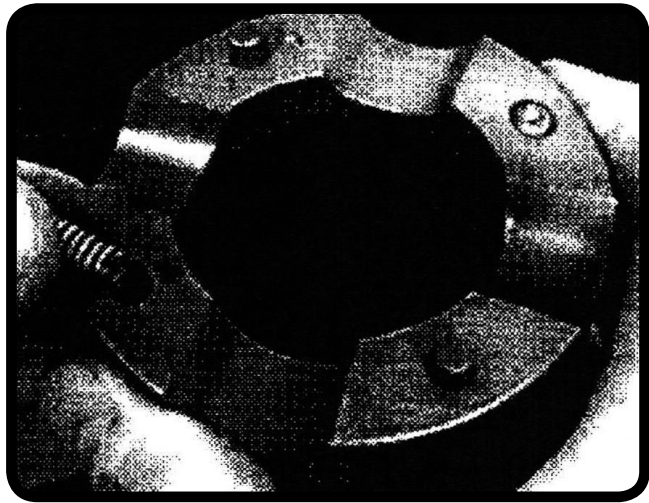


Figure 11
Place springs, pins (with grease) in other driver

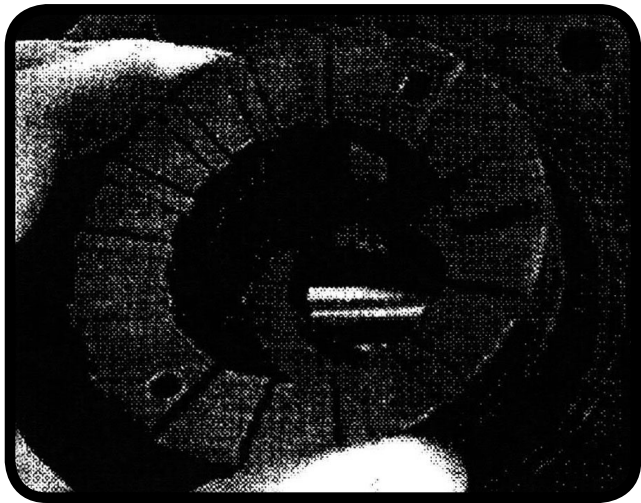


Figure 12

Install top driver with pins lining up with springs

Install it with ring gear pushed all the way into the drive pinion—that is, with no backlash, and with the bearing races pushed all the way onto the bearings.

4. Check the punch marks on the adjusters and determine which one goes on the side nearest the ring gear. Hold it so that the mark is at its final position (where the lock will be installed, pointing away from the carrier). Push the adjuster against the race and slide it down into the threads in the carrier. They should mesh easily, with no space between the parts.

5. Install the correctly-marked cap. Use the bolts as guides by turning them in two threads or so and then sliding the cap down to meet the case. Be sure that the cap threads fit into those in the adjuster. Do not force anything. The cap should slide down very close to the carrier surface. Tighten the bolts until they are snug.

6. Hold the other adjuster so that the mark is in the same relative position as the first one (with the mark away from the carrier) and slide it down the bearing race into the threads. As it meshes it should shift outward a little and be positioned

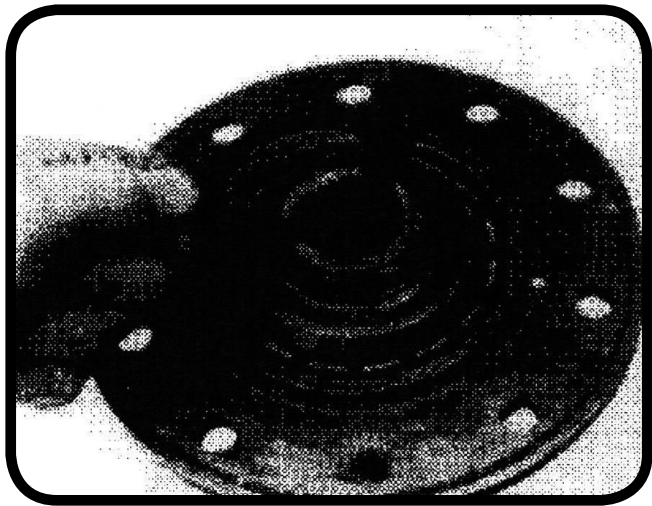


Figure 13
Install other side gear and thrust washer

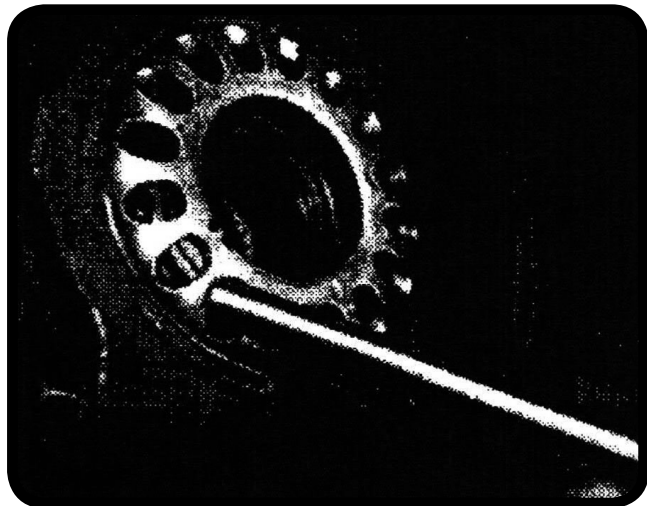


Figure 14
Turn other adjuster to final position; install lock

slightly away from the race.

7. Install the other cap. Again, use the bolts as guides by turning them in two threads or so and then sliding the cap down to meet the case. Turn the bolts until they are barely snug. Be sure that the cap threads fit into those in the adjuster. Do not force anything.

8. Use a spanner wrench or a blunt punch and a hammer to turn the second adjuster (the one away from the ring gear) one turn inward (clockwise) until the marked hole reaches its final position (in the middle of the cap just below the lock). The last portion of the turn should be difficult because pre-load is being applied to the bearings by spreading the caps apart as the adjuster is being turned in (**Figure 14**).

9. Insert an axle shaft or bar into one of the axle shaft holes in the differential case to help with holding the assembly or place it in a large vise, and torque the cap bolts to their correct value (see the shop manual).

10. Install the adjuster locks and torque the bolts. Be sure that they are located in the marked holes.

Differential Assembly Inspection

When the above steps are completed, all the parts should be in exactly the same positions as they were when the installation began. The backlash and pre-load settings should therefore be unchanged and no further adjustments will be needed. To be certain, **rock the ring gear** back and forth to see if the backlash appears to be the same as it was prior to the installation. If not, it will need to be reset with a dial indicator as described in the shop manual. Rotate the ring gear one revolution to be sure that nothing is binding.

Third Member Installation

1. Clean the mating surface of the axle housing and the mounting surface of the differential carrier.

2. Clean the inside of the axle housing to remove all foreign material. This step is very important because metal chips can interfere with the operation of your new **LOCK-RIGHT**

3. Remove metal chips from the drain plug if it is magnetic.

4. **Install a gasket** and/or sealant as appropriate.
5. **Lift the third member** into the axle housing
6. **Install and torque** the hardware.

Vehicle Final Assembly

Finish the assembly of the remaining parts by reversing the order of disassembly—in general, the axles/backing plates, brake lines, emergency brake cables, drive shafts, tires. Note that in some designs the last 1/8-inch or so of the backing plate installation is a light press fit and the axle shaft may appear to be hitting something. Tap the outside end of the axle housing, check to be sure that they are in their correct positions. Refer to the shop manual for specific instructions. Your **LOCK-RIGHT** installation should now be complete. As a preliminary test, rotate the tires back and forth (transmission out of gear and drive shaft free). The drivers should randomly unlock and “click” as the tires move. Note that the tires will NOT lock together—this easy-unlocking characteristic is a unique feature of the **LOCK-RIGHT** and is perfectly normal.

Add gear oil. Note that we suggest using medium-to-heavy oils as recommended by the manufacturer, unless the vehicle will be used in very cold weather.

Thicker oil, such as 85-140, reduces the “clicking” noise sometimes heard during tight turns and provides adequate lubrication when the assembly becomes hot. Also see the section in the Vehicle Operator’s Manual regarding temperature.

Tire Diameters

To help assure a long life for your new **LOCK-RIGHT, tire diameters should be as nearly equal as possible**. Contrary to instructions that you may have read elsewhere, **DO NOT** change the inflation pressure to vary the rolling radius of the tire! This practice can be dangerous if one of the tires is under-inflated, producing excess heat, faster tire wear and more difficult vehicle control. The best way to equalize the rotation is to measure the circumference of all the tires, including the spare. Choose ones that are within about 3/8-inch or less of each other (do not change from side-to-side if they are radials). If one tire is much

more worn than the other one, they both should be replaced for safety reasons.

Testing Your Installation

1. Be sure that the vehicle is safely blocked. Leave the axle assembly on the jack stands, with both tires free to rotate and the emergency brake off.

2. Put the transmission and transfer case in gear to lock the drive shaft.

3. Rotate one of the tires in the forward direction with your hand until it stops, then hold it. That side of the **LOCK-RIGHT** is now locked.

4. Rotate the other tire in the opposite (reverse) direction. The **LOCK-RIGHT** should “click” as the coupler attached to the axle rotates.

5. Rotate the first tire in the reverse direction and hold it; repeat step 3, rotating the other tire in the forward direction.

6. Repeat steps 2-4, rotating and holding the second tire to lock the second side.

Driving Your Vehicle

If the foregoing measurements and tests have been successfully completed, apply the emergency brake and remove the vehicle from the jack stands. Your vehicle should now be ready to drive.

*Carefully read and understand the driving information contained in the **LOCK-RIGHT** Vehicle Owner's Manual!* Safe and effective use of your new **LOCK-RIGHT**-equipped vehicle depends on knowledgeable operation, and this can only be done by understanding its characteristics before you start. Be careful, and have fun!

NOTE: If an axle snaps repeatedly under power when driving on the street (as opposed to lightly clicking in a turn), the teeth on the used side gears may be too worn to function properly. Sustained operation under these conditions is quite easy to observe and will void the warranty. Replace the side gears immediately to eliminate the problem or contact your dealer for assistance.

Warranty Information

The Warranty is contained in the Vehicle Owner's Manual that is supplied with your new **LOCK-RIGHT**. Consult this manual for complete warranty information.



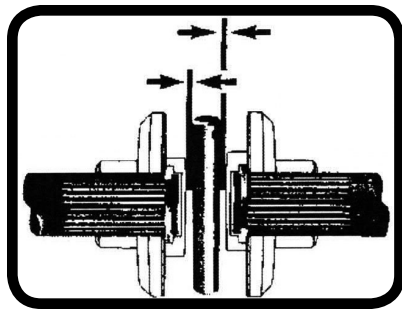
IMPORTANT

If your differential case or thrust washers are excessively worn, your new **LOCK-RIGHT** Locker may not be able to operate as it was designed. Therefore, two easy measurements must be made before final assembly to assure that your new locker will function properly. To make these measurements, proceed as follows:

1. Remove the existing spider gears, side gears and thrust washers from the differential case, and thoroughly clean it.
2. Install the **LOCK-RIGHT** couplers with the existing thrust washers in each end of the case.
3. Place the spacers onto the centers of the couplers (wide side toward the axle splines if not symmetrical), and hold them there.
4. Install the pinion shaft; carefully guide it past the spacers as it is being inserted through the holes in the case.
5. Measure the gap between each spacer and the pinion shaft with a feeler gauge. This gap should be between .005-inch and .020-inch, with not more than an .008-inch difference between the two.

If your numbers are within the limits specified, remove the parts and begin your installation. If your numbers are not within these limits, check the thrust washers and the differential case. If they are excessively worn or are damaged, they may need to be replaced before installing your new Lock-Right Locker.

If you have any questions, call PowerTrax Customer Service at 1.864.843.9275 (8AM-6PM ET) for further assistance.



WARNING!

IMPORTANT INFORMATION Please Read Carefully

CAUTION!

The following [WARNING] and [CAUTION] information is supplied to you for your protection and to provide you with many years of trouble free and safe operation of your Richmond Gear product.

Read **ALL** instructions prior to operating transmission and/or ring and pinion. Injury to personnel, transmission or ring and pinion failure may be caused by improper installation, maintenance or operation.

DANGER!

•It is **dangerous to get under a jacked-up vehicle**. The vehicle could slip off the jack and fall on you. You could be crushed. Never place any part of your body under a vehicle that is on a jack. Never start or run the engine while the vehicle is on a jack. **If you need to get under a raised vehicle, take it to a service center where it can be raised on a lift.**

WARNING!

•Hot oil can cause severe burns. Use extreme care when removing lubrication plugs and when working close to a unit that has been in operation.

- Check lube level between scheduled lube changes to insure that proper lube level is maintained. Inspect vent plug to insure it is clean and operating. Inspect the tightness of mounting bolts, misalignment of connecting shafts, lube leakage, excessive heating, or any unusual noise or vibration.
- Serious personal injury may occur as a result of improperly performed maintenance, adjustments or repairs.
- Do not attempt any of the maintenance, checks or repairs described on the following pages if you are not fully familiar with these or other procedures with respect to the transmission, or are uncertain as to how to proceed. Have the necessary work done by a properly equipped and qualified workshop.
- Always be extremely careful when working on the transmission. Always follow commonly accepted safety practices and general common sense. Never risk personal injury.

(continued on next page)

CAUTION!

- Do not operate the transmission or ring and pinion without proper lube and correct amount.
- For safe operation and to maintain the unit warranty, when changing a factory installed fastener for any reason, it becomes the responsibility of the person making the change to properly account for fastener grade, thread engagement, load, tightening torque and the means of torque retention.
- Mounting bolts should be periodically checked to ensure that the unit is firmly anchored for proper operation.
- These instructions are not intended to cover all details or variations in equipment, nor provide for every possible contingency to be met in connection with selection, installation, operation, and maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the Buyer's purpose, the matter should be referred to Richmond Gear.

In the event of the resale of any of the goods, in whatever form, Resellers/Buyers will include the following language in a conspicuous place and in a conspicuous manner in a written agreement covering such sale:

The manufacturer makes no warranties or representations, express or implied, by operation of law or otherwise, as to the merchantability or fitness for a particular purpose of the goods sold hereunder. Buyer acknowledges that it alone has determined that the goods purchased hereunder will suitably meet the requirements of their intended use. In no event will the manufacturer be liable for consequential, incidental or other damages. Even if the repair or replacement remedy shall be deemed to have failed of its essential purpose under Section 2-719 of the Uniform Commercial code, the manufacturer shall have no liability to Buyer for consequential damages.

Resellers/Buyers agree to also include this entire document including the danger, warnings and cautions above in a conspicuous place and in a conspicuous manner in writing to instruct users on the safe usage of the product.

This information should be read together with all other printed information supplied by Richmond Gear.

NOTES:



Installation Update Lock-Right Model #1810 Manual Addendum #1000-760

The model 1810 Lock-Right for the Ford 9-inch differential has been on the market for about five years. In that time many thousands have been sold, and the Lock-Right is successfully being used world-wide.

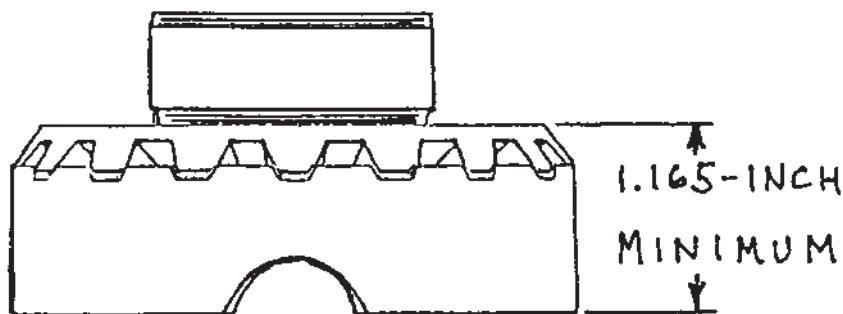
During recent months, problems with fitting some of the internal differential parts have occurred. This has lead to the conclusion that some parts in the field may be either of very early Ford manufacture (late 1950's) or made by aftermarket sources.

The thickness of the combination of only the side gear and Lock-Right driver (no thrust washer installed), with the teeth meshed, should be 1.165-inch minimum! If this measurement is under 1.165-inch, the Lock-Right will not operate properly, and the drivers and pins may become damaged.

Be sure to check this measurement with a micrometer or dial caliper before installation. If these instruments are not available, the combination may be placed on a table top and measured with a ruler. the combination should measure slightly less than 1-3/16 (1.188-inch). If this measurement is less than the minimum 1.165-inch, the gears are incompatible with your new Lock-right and the correct ones must be obtained before installation.

Note: For reference--we have found two different designs of incompatible side gears. One side gear and driver combination measures 1.107-inch thick, and the other combination measures 1.140-inch thick. Neither one will operate properly, as detailed above.

Also note: Check the side gear thrust washers, which must be placed under the side gears during the installation. They should be about 0.030-inch thick and be free from cracking and/or galling.



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